Embedding Deep Learning in Inverse Scattering Solutions

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This paper demonstrates a technique to integrate deep learning with existing algorithms for electromagnetic inverse scattering problems. Specifically, we address the problem of getting trapped in false local minima when recovering high permittivity objects. This problem is encountered when using existing inverse scattering techniques such as the Contrast Source Inversion (CSI) and Subspace-Optimization Method (SOM). To this end, we modify these methods by introducing deep learning in the solution strategy. Our contribution to the inverse scattering problem through this paper is two-fold. Firstly, we provide a framework for incorporating deep learning based methods in the existing iterative solutions to the inverse scattering problem. This framework allows for estimating the dielectric profiles for relatively stronger scatterers than the original versions of CSI/SOM would have allowed. Secondly, we introduce a novel deep convolutional network (DCN) architecture, which allows for better estimation of the contrast source. Extensive numerical experiments show superiority of the proposed scheme in its ability to recover objects of high electrical permittivity without any significant increase in the computation time.